Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (previously presented): A method of analyzing a stream of ions, the method comprising:

(1) subjecting a stream of ions to a first mass analysis at a pressure no higher than approximately 2×10^{-5} torr, to select ions having a mass-to-charge ratio in a first desired range;

(2) passing the selected ions into a radio frequency linear ion trap (Q2) containing a gas;

(3) trapping the selected ions in the linear ion trap (Q2) and exciting the trapped ions to cause collisions with the gas and fragmentation;

(4) subjecting the fragment ions to a secondary excitation, different from the first excitation to cause excitation and fragmentation of selected fragment ions; and

(5) passing the ions out of the linear ion trap (Q2) and subjecting the ions to a further mass analysis to determine the mass spectrum of the ions.

Claim 2 (previously presented): A method as claimed in Claim 1, which includes, prior to subjecting the fragment ions to the secondary excitation, applying a signal to the linear ion trap (Q2) to isolate ions having a mass-to-charge ratio in a second desired range, wherein subjecting the fragment ions to the secondary excitation comprises exciting the isolated ions having a mass-to-charge ratio in the second desired range.

Claim 3 (previously presented): A method as claimed in Claim 2, which includes, while trapping the ions in the linear ion trap, effecting multiple cycles of:

(1)   isolating ions having a mass-to-charge ratio in a further desired range; and

(2)   exciting the isolated ions having a mass-to-charge ratio in the further desired range to cause fragmentation.

Claim 4 (previously presented): A method as claimed in Claim 1, 2, or 3 wherein passing the selected ions into the linear ion trap comprises passing the selected ions into the linear ion trap with sufficient energy to promote collision induced dissociation, the energy providing the excitation of the trapped ions, whereby trapping the selected ions in the linear ion trap comprises applying a signal to the linear ion trap to trap ions before subjecting the ions to the further mass analysis.

Claim 5 (previously presented): A method as claimed in Claim 1, 2, or 3 which comprises exciting the ions in the linear ion trap by providing a signal to the linear ion trap.

Claim 6 (previously presented): A method as claimed in Claim 1, wherein the further mass analysis is carried out in a quadrupole mass analyzer (Q3).

Claim 7 (previously presented): A method as claimed in Claim 1, wherein the further mass analysis is carried out in a time of flight mass analyzer.

Claim 8 (previously presented): A method as claimed in Claim 7 wherein the further mass analysis is carried out in a time of flight mass analyzer arranged with its axis perpendicular to the axis of the linear ion trap (Q2).

Claim 9 (previously presented): A method as claimed in Claim 1 wherein each mass analysis is carried out in one of: a linear quadrupole (Q3); a linear time of flight analyzer; a reflectron time of flight analyzer; a single magnetic sector analyzer; a double focusing two sector mass analyzer having an electric sector and a magnetic sector; a Paul trap; a Wien filter; a Mattauch-Herzog spectrograph; ion cyclotron mass spectrometer; and a Thomson parabolic mass spectrometer.

Claim 10 (previously presented): A method as claimed in Claim 6, 7, 8, or 9, wherein the first mass analysis is carried out in a quadrupole mass analyzer (Q1) which is coaxial with the linear ion trap (Q2).

Claim 11 (previously presented): A method as claimed in Claim 1, which includes, prior to exciting the trapped ions, subjecting the trapped ions to a signal comprising a plurality of excitation signals uniformly spaced in a frequency domain and having a notch, wherein the notch covers a desired frequency band and there are no excitation signals in the frequency band of the notch, and wherein the excitation signals have sufficient magnitude to excite and eject ions except for ions having an excitation frequency within the frequency band of the notch.

Claim 12 (original): A method as claimed in Claim 11, which comprises applying a combination of signals comprising sine waves and with frequencies up to f/2, where f is the frequency of the trapping RF.

Claim 13 (canceled)

Claim 14 (currently amended): A method as claimed in Claim 11[[,]] or 12 [[or 13]], which includes, after selection of a desired ion, exciting the desired ion with a signal comprising a sine wave at or near the resonant frequency of the ion.

Claim 15 (previously presented): A method as claimed in Claim 7, which includes providing an exit lens between the linear ion trap (Q2) and the time of flight device, and lowering the voltage on the exit lens to permit ions to pass into the time of flight device, the method further comprising providing a signal to a repeller grid of the time of flight device, to cause the time of flight device to scan at a desired rate.

Claim 16 (canceled)

Claim 17 (previously presented): An apparatus for effecting mass analysis and fragmentation of an ion stream, the apparatus comprising:

an input for an ion stream;

a first mass analyzer (Q1) at a pressure no higher than approximately 2×10^{-5} torr to select ions having a mass-to-charge ratio in a desired range;

a radio frequency linear ion trap (Q2) to receive the selected ions;

a final mass analyzer; and,

an auxiliary drive connected to the radio frequency linear ion trap (Q2) for effecting multiple excitation steps.

Claim 18 (original): An apparatus as claimed in Claim 17, wherein the first mass analyzer (Q1) comprises a quadrupole mass analyzer.

Claim 19 (original): An apparatus as claimed in Claim 17 or 18, wherein the final mass analyzer (Q3) comprises a quadrupole mass analyzer, and the first mass analyzer (Q1), the linear ion trap (Q2) and the final mass analyzer (Q3) are axially aligned with one another.

Claim 20 (previously presented): An apparatus as claimed in Claim 17 or 18, wherein the final mass analyzer (Q3) comprises a time of flight device.

Claim 21 (previously presented): An apparatus as claimed in Claim 17 or 18, wherein the linear ion trap (Q2) includes a multipole rod set.

Claim 22 (previously presented): An apparatus as claimed in Claim 19, wherein the linear ion trap (Q2) comprises a quadrupole rod set and wherein the rods of the mass analyzers (Q1 and Q3) and of the linear ion trap (Q2) have substantially similar radii and substantially similar spacings.

Claim 23 (previously presented): An apparatus as claimed in Claim 17, wherein each of the first analyzer (Q1) and the final analyzer (Q3) comprise one of: a linear quadrupole; a linear time of flight analyzer; a reflectron time of flight analyzer; a single magnetic sector analyzer; a double focusing two sector mass analyzer having an electric sector and a magnetic sector; a Paul trap; a Wien filter; a Mattauch-Herzog spectrograph; an ion cyclotron mass spectrometer; and a Thomson parabolic mass spectrometer.

Claim 24 (original): An apparatus as claimed in Claim 23, wherein the linear ion trap (Q2) includes a multipole rod set.

Claim 25 (previously presented): An apparatus as claimed in Claim 17, wherein the linear ion trap (Q2) has a pair of opposed x rods and a pair of opposed y rods, wherein a main RF drive is connected to the x and y rods of the linear ion trap (Q2), and wherein the auxiliary drive is connected to at least one pair of rods of the linear ion trap (Q2).

Claim 26 (previously presented): An apparatus as claimed in Claim 25, wherein the auxiliary drive is connected to the y rods of the linear ion trap (Q2) through a transformer, and wherein the main RF drive is connected directly to the x rods of the linear ion trap (Q2) and, through a coil of the transformer to the y rods.

Claim 27 (previously presented): An apparatus as claimed in Claim 25, which includes an arbitrary waveform generator connected to the auxiliary drive, for applying a selected waveform to the linear ion trap (Q2) to excite ions therein.

Claim 28 (new): A method of analyzing a stream of ions, the method comprising:

(1)   subjecting a stream of ions to a first mass analysis at a pressure no higher than approximately 2×10^{-5} torr, to select ions having a mass-to-charge ratio in a first desired range;

(2)   passing the selected ions into a radio frequency linear ion trap (Q2) containing a gas;

(3)   trapping the selected ions in the linear ion trap (Q2);

(4)   subjecting the trapped ions to a signal comprising a plurality of excitation signals uniformly spaced in a frequency domain and having a notch, wherein the notch covers a desired frequency band and there are no excitation signals in the frequency band of the notch, and wherein the excitation signals have sufficient magnitude to excite and eject ions except for ions having an excitation frequency within the frequency band of the notch, which comprises applying a combination of signals having sine waves with frequencies in the range 10 to 500 kHz and spaced at 500 Hz

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> intervals, and the frequency band of the notch has a width of 1-10 kHz and is centered on the resonant frequency of an ion of interest;
>
> (5) exciting the trapped ions to cause collisions with the gas and fragmentation;
>
> (6) subjecting the fragment ions to a further excitation, different from the excitation of step (5) to cause excitation and fragmentation of selected fragment ions; and
>
> (7) passing the ions out of the linear ion trap (Q2) and subjecting the ions to a further mass analysis to determine the mass spectrum of the ions.

Claim 29 (new): A method as claimed in Claim 28, which includes, after selection of a desired ion, exciting the desired ion with a signal comprising a sine wave at or near the resonant frequency of the ion.

Claim 30 (new): A method as claimed in Claim 28, wherein the further mass analysis is carried out in a quadrupole mass analyzer (Q3).

Claim 31 (new): A method as claimed in Claim 28, wherein the further mass analysis is carried out in a time of flight mass analyzer.

Claim 32 (new): A method as claimed in Claim 31 wherein the further mass analysis is carried out in a time of flight mass analyzer arranged with its axis perpendicular to the axis of the linear ion trap (Q2).

Claim 33 (new): A method as claimed in Claim 28 wherein each mass analysis is carried out in one of: a linear quadrupole (Q3); a linear time of flight analyzer; a reflectron time of flight analyzer; a single magnetic sector analyzer; a double focusing two sector mass analyzer having an electric sector and a magnetic sector; a Paul trap; a Wien filter; a Mattauch-Herzog spectrograph; ion cyclotron mass spectrometer; and a Thomson parabolic mass spectrometer.

Claim 34 (new): A method as claimed in Claim 30, 31, 32, or 33, wherein the first mass analysis is carried out in a quadrupole mass analyzer (Q1) which is coaxial with the linear ion trap (Q2).

Claim 35 (new): A method of analyzing a stream of ions, the method comprising:

(1) subjecting a stream of ions to a first mass analysis at a pressure no higher than approximately 2×10^{-5} torr, to select ions having a mass-to-charge ratio in a first desired range;

(2) passing the selected ions into a radio frequency linear ion trap (Q2) containing a gas;

(3) trapping the selected ions in the linear ion trap (Q2) and exciting the trapped ions to cause collisions with the gas and fragmentation;

(4) subjecting the fragment ions to a secondary excitation, different from the first excitation to cause excitation and fragmentation of selected fragment ions; and

(5) passing the ions out of the linear ion trap (Q2) and subjecting the ions to a further mass analysis to determine the mass spectrum of the ions, the further mass analysis is carried out in a time of flight mass analyzer,

and wherein passing the selected ions into the linear ion trap (Q2) is for a period of substantially 5ms, subjecting the ions in the linear ion trap (Q2) to an excitation signal to excite and eject undesired ions is for a period of substantially 4ms, exciting the desired ions is for a period of substantially 4ms and passing the ions out of the linear ion trap (Q2) and scanning the time of flight device is for substantially 7ms.

Claim 36 (new): A method as claimed in Claim 35, which includes providing an exit lens between the linear ion trap (Q2) and the time of flight device, and lowering the voltage on the exit lens to permit ions to pass into the time of flight device, the method further comprising providing a signal to a repeller grid of the time of flight device, to cause the time of flight device to scan at a desired rate.

Claim 37 (new): A method as claimed in Claim 35, which includes, prior to subjecting the fragment ions to the secondary excitation, applying a signal to the linear ion trap (Q2) to isolate ions having a mass-to-charge ratio in a second desired range, wherein subjecting the fragment ions to the secondary excitation comprises exciting the isolated ions having a mass-to-charge ratio in the second desired range.

Claim 38 (new): A method as claimed in Claim 37, which includes, while trapping the ions in the linear ion trap, effecting multiple cycles of:

   (1)   isolating ions having a mass-to-charge ratio in a further desired range; and

   (2)   exciting the isolated ions having a mass-to-charge ratio in the further desired range to cause fragmentation.

Claim 39 (new): A method as claimed in Claim 35, 37, or 38 wherein passing the selected ions into the linear ion trap comprises passing the selected ions into the linear ion trap with sufficient energy to promote collision induced dissociation, the energy providing the excitation of the trapped ions, whereby trapping the selected ions in the linear ion trap comprises applying a signal to the linear ion trap to trap ions before subjecting the ions to the further mass analysis.

Claim 40 (new): A method as claimed in Claim 35, 37, or 38 which comprises exciting the ions in the linear ion trap by providing a signal to the linear ion trap.

Claim 41 (new): A method as claimed in Claim 35 wherein the time of flight mass analyzer is arranged with its axis perpendicular to the axis of the linear ion trap (Q2).

Claim 42 (new): A method as claimed in Claim 40, or 41, wherein the first mass analysis is carried out in a quadrupole mass analyzer (Q1) which is coaxial with the linear ion trap (Q2).

Claim 43 (new): A method as claimed in Claim 35, which includes, prior to exciting the trapped ions, subjecting the trapped ions to a signal comprising a plurality of excitation signals uniformly spaced in a frequency domain and having a notch, wherein the notch covers a desired frequency band and there are no excitation signals in the frequency

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band of the notch, and wherein the excitation signals have sufficient magnitude to excite and eject ions except for ions having an excitation frequency within the frequency band of the notch.

Claim 44 (new): A method as claimed in Claim 43, which comprises applying a combination of signals comprising sine waves and with frequencies up to f/2, where f is the frequency of the trapping RF.

Claim 45 (new) A method as claimed in Claim 44, which comprises applying a combination of signals having sine waves with frequencies in the range 10 to 500 kHz and spaced at 500 Hz intervals, and the frequency band of the notch has a width of 1-10 kHz and is centered on the resonant frequency of an ion of interest.

Claim 46 (new): A method as claimed in Claim 43, 44, or 45, which includes, after selection of a desired ion, exciting the desired ion with a signal comprising a sine wave at or near the resonant frequency of the ion.